

# Production cross sections of $^{261}\text{Ha}$ from $^{250}\text{Cf}(^{15}\text{N},4n)$ and $^{243}\text{Am}(^{22}\text{Ne},4n)$ reactions

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In 1971, Ghiorso et al.<sup>1</sup> produced  $^{261}\text{Ha}$  by the reactions  $^{250}\text{Cf}(^{15}\text{N},4n)$  and  $^{249}\text{Bk}(^{16}\text{O},4n)$ . They were able to assign a half-life of  $1.8 \pm 0.6$  s and an  $\alpha$ -decay energy of 8.93 MeV. They observed no spontaneous fission (SF) events, and were only able to set an upper limit of 50% for the SF branch of  $^{261}\text{Ha}$ . We have measured the production cross section of  $^{261}\text{Ha}$  from two different reactions. It was produced in the  $^{250}\text{Cf}(^{15}\text{N},4n)$  reaction at 84-MeV and in the  $^{243}\text{Am}(^{22}\text{Ne},4n)$  reaction at 116-MeV. Our rotating wheel system with a special parent-daughter stepping mode was used to detect  $\alpha$ - $\alpha$  correlations between 1.8-s  $^{261}\text{Ha}$  and 0.65-s  $^{257}\text{Lr}$ . We measured thirteen and nine correlations in the two reactions, respectively. The  $\alpha$ -decay energies (see Fig. 1) and the lifetimes of these events are consistent with those of  $^{261}\text{Ha}$  and  $^{257}\text{Lr}$ . Based on a 100%  $\alpha$  branch, and assuming a 0.4-s gas-jet transport time, we have determined the production cross section of  $^{261}\text{Ha}$  to be  $0.60 \pm 0.27$  nb in the  $^{250}\text{Cf}(^{15}\text{N},4n)$  reaction at 84 MeV, and  $0.24 \pm 0.12$  nb in the  $^{243}\text{Am}(^{22}\text{Ne},4n)$  reaction at 116 MeV. Based on the number of fission events observed in the latter reaction, we have been able to set an upper limit of 18% for the spontaneous fission branch of  $^{261}\text{Ha}$ .

## Footnotes and References

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1. A. Ghiorso, M. Nurmiä, K. Eskola, and P. Eskola, Phys. Rev. C **4**, 1850 (1971).

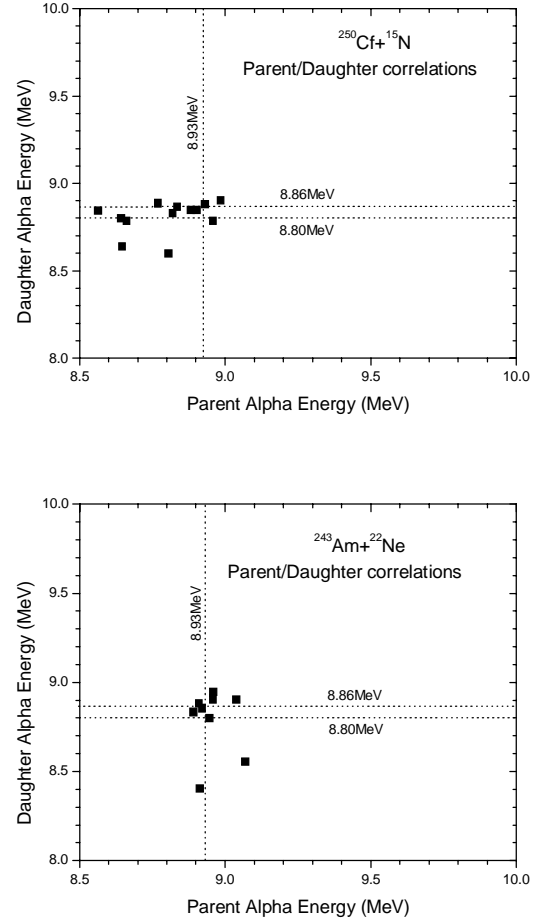


Fig. 1. Parent-daughter correlations for the reactions  $^{250}\text{Cf} + ^{15}\text{N}$  (top) and  $^{243}\text{Am} + ^{22}\text{Ne}$  (bottom). The  $\alpha$  energies of the parent and the daughter for each correlated event are plotted. As a rough guideline, the literature values of the parent (8.93 MeV) and daughter (8.80 MeV and 8.86 MeV)  $\alpha$  particle energies are shown by the dotted lines.